

CLAIMS

1. A gallium nitride-based compound semiconductor light-emitting device comprising an n-type semiconductor layer of a gallium nitride-based compound semiconductor, a light-emitting layer of a gallium nitride-based compound semiconductor and a p-type semiconductor layer of a gallium nitride-based compound semiconductor formed on a substrate in this order, and having a negative electrode and a positive electrode provided on the n-type semiconductor layer and the p-type semiconductor layer, respectively; wherein the negative electrode comprises a bonding pad layer and a contact metal layer which is in contact with the n-type semiconductor layer, and the contact metal layer is composed of a Cr-Al alloy.

2. A gallium nitride-based compound semiconductor light-emitting device according to claim 1, wherein the Cr-Al alloy has a Cr content of 10 to 90 mass%.

3. A gallium nitride-based compound semiconductor light-emitting device according to claim 2, wherein the Cr-Al alloy has a Cr content of 20 to 80 mass%.

4. A gallium nitride-based compound semiconductor light-emitting device according to claim 3, wherein the Cr-Al alloy has a Cr content of 40 to 60 mass%.

5. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 1 to 4, wherein the contact metal layer has a thickness of 1 to 500 nm.

6. A gallium nitride-based compound semiconductor light-emitting device according to claim 5, wherein the contact metal layer has a thickness of 10 nm or more.

7. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 1 to 6, wherein the bonding pad layer is formed of a metal selected from the group consisting of Au, Al, Ni, and Cu, or an alloy containing the metal.

8. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 1 to

7, wherein the bonding pad layer has a thickness of 100 to 1,000 nm.

5 9. A gallium nitride-based compound semiconductor light-emitting device according to claim 8, wherein the bonding pad layer has a thickness of 200 to 500 nm.

10 10. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 1 to 9, wherein an Au-Sn alloy layer is provided on the bonding pad layer.

11. A gallium nitride-based compound semiconductor light-emitting device according to claim 10, wherein the Au-Sn alloy layer has a thickness of 200 nm or more.

15 12. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 1 to 9, wherein a lead free solder layer is provided on the bonding pad layer.

13. A gallium nitride-based compound semiconductor light-emitting device according to claim 12, wherein the lead free solder layer has a thickness of 200 nm or more.

20 14. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 1 to 13, wherein the light-emitting device has an adhesion layer formed of Ti between the contact metal layer and the bonding pad layer.

25 15. A gallium nitride-based compound semiconductor light-emitting device according to claim 14, wherein the adhesion layer has a thickness of 1 to 100 nm.

30 16. A gallium nitride-based compound semiconductor light-emitting device according to claim 15, wherein the adhesion layer has a thickness of 10 nm or more.

35 17. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 1 to 13, wherein the light-emitting device has a barrier layer between the contact metal layer and the bonding pad layer.

18. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 10

to 16, wherein the light-emitting device has a barrier layer between the bonding pad layer and the Au-Sn alloy layer or the lead free solder layer.

5 19. A gallium nitride-based compound semiconductor light-emitting device according to claim 17 or 18, wherein the barrier layer is formed of a metal selected from the group consisting of Ti, Zr, Hf, Ta, W, Re, Os, Ir, Pt, Fe, Co, Ni, Ru, Rh, and Pd, or an alloy containing the metal.

10 20. A gallium nitride-based compound semiconductor light-emitting device according to claim 19, wherein the barrier layer is formed of a metal selected from the group consisting of Ti, Ta, W, and Pt, or an alloy containing the metal.

15 21. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 17 to 20, wherein the barrier layer has a thickness of 10 to 500 nm.

20 22. A gallium nitride-based compound semiconductor light-emitting device according to claim 21, wherein the barrier layer has a thickness of 50 to 300 nm.

25 23. A gallium nitride-based compound semiconductor light-emitting device according to any one of claims 1 to 22, wherein the light-emitting device is of a flip-chip type.

30 24. A negative electrode for use in a gallium nitride-based compound semiconductor light-emitting device comprising a bonding pad layer and a contact metal layer which is in contact with the n-type semiconductor layer, wherein the contact metal layer is composed of a Cr-Al alloy.

35 25. A negative electrode for use in a gallium nitride-based compound semiconductor light-emitting device according to claim 24, wherein the light-emitting device is of a flip-chip type.